

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

RECEIVED
CENTRAL FAX CENTER
JUN 14 2007

Amendments to the Claims:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. **(Currently Amended)** An illumination assembly comprising:
a substrate comprising an electrically insulative layer on a first side of the substrate and ~~[[an]]~~ a patterned electrically conductive layer on a second side of the substrate;
a plurality of LED dies, each LED die disposed in a via extending through the electrically insulative layer on the first side of the substrate to the patterned electrically conductive layer on the second side of the substrate, wherein each LED die is electrically and thermally connected through the via to the patterned electrically conductive layer on the second side of the substrate.
2. **(Original)** The illumination assembly of claim 1, wherein the substrate is flexible.
3. **(Original)** The illumination assembly of claim 1, wherein the electrically insulative layer on the first side of the substrate comprises a material selected from the group comprising polyimide, polyester, polyethyleneterephthalate (PET), optically reflective insulative polymers, multilayer optical film (MOF), polycarbonate, polysulfone, FR4 epoxy composite, and combinations thereof.
4. **(Original)** The illumination assembly of claim 1, wherein the via extending through the electrically insulative material is chemically etched.
5. **(Original)** The illumination assembly of claim 1, wherein the via extending through the electrically insulative material is plasma etched.
6. **(Original)** The illumination assembly of claim 1, wherein the via extending through the electrically insulative material is laser milled.

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

7. **(Original)** The illumination assembly of claim 1, wherein the electrically conductive layer on the second side of the substrate comprises a material selected from the group comprising copper, nickel, gold, aluminum, tin, lead, or a combination thereof.
8. **(Original)** The illumination assembly of claim 1, wherein the electrically conductive layer on the second side of the substrate comprises a thermally conductive material.
9. **(Original)** The illumination assembly of claim 1, wherein the electrically conductive layer is patterned to define a plurality of electrically isolated heat spreading elements, each LED die electrically and thermally coupled to an associated heat spreading element.
10. **(Original)** The illumination assembly of claim 1, further comprising a heat dissipation assembly disposed adjacent the second side of the substrate.
11. **(Original)** The illumination assembly of claim 10, wherein the heat dissipation assembly is separated from the second side of the substrate by a layer of material that is thermally conductive.
12. **(Previously Presented)** The illumination assembly of claim 11, wherein the thermally conductive material is an adhesive.
13. **(Previously Presented)** The illumination assembly of claim 12, wherein the thermally conductive adhesive material is a polymer adhesive loaded with boron nitride.
14. **(Previously Presented)** The illumination assembly of claim 11, wherein the thermally conductive material is non-adhesive.
15. **(Previously Presented)** The illumination assembly of claim 14, wherein the thermally conductive non-adhesive material is a polymer loaded with silver particles.

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

16. **(Original)** The illumination assembly of claim 10, wherein the heat dissipation assembly comprises a thermally conductive member.
17. **(Original)** The illumination assembly of claim 16, wherein the thermally conductive member comprises a material selected from the group comprising metals and polymers.
18. **(Currently Amended)** An illumination apparatus comprising:
a substrate having an electrically insulative layer on a first surface and [[an]] a patterned
electrically conductive layer on a second surface, a plurality of mounting vias extending
through the electrically insulating layer to the patterned electrically conductive layer;
a plurality of light emitting elements disposed in the plurality of mounting vias, wherein the light
emitting elements are electrically and thermally connected to the patterned electrically
conductive layer through the mounting vias.
19. **(Original)** The illumination apparatus of claim 18, wherein the electrically conductive layer is patterned to define a plurality of heat spreading elements
20. **(Original)** The illumination apparatus of claim 18, wherein the light emitting elements are LED dies.
21. **(Original)** The illumination apparatus of claim 18, wherein the light emitting elements are selected from the group comprising light emitting diodes, laser diodes and super-radiators.
22. **(Original)** The illumination apparatus of claim 18, wherein each of the plurality of mounting vias receives a single light emitting element.
23. **(Original)** The illumination apparatus of claim 18, further comprising a plurality of wirebond vias extending through the electrically insulating layer to the electrically conductive

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

layer, each wirebond via exposing a corresponding wirebond connection pad of the electrically conductive layer.

24. **(Original)** The illumination apparatus of claim 18, further comprising a thermally conductive encapsulant contacting the light emitting elements and electrically insulating layer.

25. **(Original)** The illumination apparatus of claim 18, wherein the substrate is flexible.

26. **(Original)** An illumination apparatus comprising:

a layer of electrically insulative material;

a layer of thermally and electrically conductive material disposed on a bottom surface of the layer of insulative material, the conductive material patterned to form a plurality of adjacent heat spreading elements;

a plurality of vias in the insulative material, each via extending through the insulative material to an associated heat spreading element;

a plurality of light emitting elements, each light emitting element disposed in one of the plurality of vias, each light emitting element thermally and electrically coupled to the heat spreading element associated with the via.

27. **(Original)** The illumination apparatus of claim 26, wherein each light emitting element is further electrically coupled to an electrical connection pad of an adjacent heat spreading element.

28. **(Cancelled)**

29. **(Previously Presented)** The illumination apparatus of claim 27, wherein each light emitting element is electrically coupled to the electrical connection pad of an adjacent heat spreading element by a wirebond.

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

30. **(Original)** The illumination apparatus of claim 27, wherein each light emitting element is electrically coupled to the electrical connection pad of an adjacent heat spreading element within the via.

31. **(Original)** The illumination apparatus of claim 26, wherein the layer of electrically insulative material is flexible.

32. **(Original)** The illumination apparatus of claim 31, wherein the layer of thermally and electrically conductive material is flexible.

33. **(Original)** The illumination apparatus of claim 26, further comprising a heat dissipation assembly thermally coupled to the plurality of heat spreading elements.

34. **(Cancelled)**

35. **(Previously Presented)** A flexible circuit comprising:
a flexible layer of electrically insulative material, wherein the insulative material comprises an at least partially reflective multilayer optical film;
a flexible layer of electrically conductive material disposed on a first surface of the insulative material, the conductive material patterned to form a plurality of adjacent heat spreading elements, each heat spreading element having a first electrical connection pad and a second electrical connection pad;
a plurality of mounting vias extending through the insulative material, wherein each mounting via exposes the first electrical connection pad of an associated heat spreading element.

36. **(Original)** The flexible circuit of claim 35, wherein each mounting via further exposes the second electrical connection pad of an adjacent heat spreading element.

U.S. Patent Application Serial No. 10/727,220
Reply to Office Action of March 14, 2007

37. **(Original)** The flexible circuit of claim 35, further comprising a plurality of connection vias extending through the insulative material, wherein each connection via exposes the second electrical connection pad of an associated heat spreading element.

38. **(Cancelled)**

39. **(Previously Presented)** The flexible circuit of claim 38, wherein the multilayer optical film is shaped into a non-planar structure.

40. **(New)** The illumination assembly of claim 1, wherein the patterned electrically conductive layer comprises an array of spaced apart heat spreading elements.

41. **(New)** The illumination assembly of claim 1, wherein each LED die is electrically connected to at least two adjacent heat spreading elements.

42. **(New)** The illumination assembly of claim 18, wherein the patterned electrically conductive layer comprises an array of spaced apart heat spreading elements.

43. **(New)** The illumination assembly of claim 18, wherein each light emitting elements is electrically connected to at least two adjacent spaced apart heat spreading elements.